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Endophragmiella spp. nov. and new records from southern China

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Abstract—Four new species—*Endophragmiella chinensis*, *E. guangdongensis*, *E. lushanensis*, and *E. obovoidea*—collected on dead branches of unidentified plants in southern China, are described, illustrated, and compared with closely related species. From the same habitat, three other species, *E. cantabrica*, *E. ellisii*, and *E. uniseptata* are recorded from China for the first time.

Key words—asexual *Ascomycota*, hyphomycetes, saprobes, taxonomy

Introduction

Endophragmiella B. Sutton was established (Sutton 1973) for two species, *E. pallescens* B. Sutton (generic type) and *E. canadensis* (Ellis & Everh.) B. Sutton [= *E. subolivacea* (Ellis & Everh.) S. Hughes; see Hughes 1979]. *Endophragmiella* is mainly characterized by solitary, acrogenous, aseptate or euseptate conidia seceding rhexolytically from monoblastic, integrated, terminal, determinate or percurrently elongating conidiogenous cells on simple or branched conidiophores (Sutton 1973, Ellis 1976, Hughes

1979, Holubová-Jechová 1986, Wang 1990, Wu & Zhuang 2005, Seifert & al. 2011). Hughes (1979) clarified the conidiogenesis of *Endophragmiella*, amended the generic concepts, and accepted 33 species. Subsequently, 62 species and one variety have been published in *Endophragmiella* (Index Fungorum 2020). *Endophragmiella cambrensis* M.B. Ellis (Ellis 1976) was excluded from that genus by Hughes (1979) but accepted by Wu & Zhuang (2005). *Endophragmiella dimorphospora* Awao & Udagawa ex P.M. Kirk was treated as a synonym of the prior name *E. biconstituta* (Rambelli) Matsush. by Matsushima (1989). *Endophragmiella fasciata* (R.F. Castañeda) R.F. Castañeda (Castañeda-Ruíz 1988) and *E. quadrilocularis* Matsush. (Matsushima 1993) were transferred to *Repetophragma* Subram. by Castañeda-Ruíz & al. (2006, 2011). *Endophragmiella fuliginosa* (B. Sutton) S. Hughes (Hughes 1979) was treated as *Rhexoacrodictys fuliginosa* (B. Sutton) W.A. Baker & Morgan-Jones by Baker & al. (2002). *Endophragmiella rigidiuscula* R.F. Castañeda (Castañeda-Ruiz 1988) was proposed as the type species of *Distophragmia* R.F. Castañeda & al. (Castañeda-Ruíz & al. 2015). Nine invalid *Endophragmiella* species names have been validated in Senwanna (2019). *Endophragmiella* currently contains 91 species and one variety, of which 46 species have been recorded from China (Matsushima 1980, Tzean & Chen 1989, Lu & al. 2000, Tsui & al. 2001, Zhuang 2001, Wu & Zhuang 2005, Chen & al. 2008, Zhang & al. 2010, Ma & al. 2011, 2012a,b, 2015, Ren & al. 2011, Wu & Zhang 2012, Xia & al. 2016, Li & al. 2017, Jiang & al. 2018).

During an ongoing survey of anamorphic fungi on plant debris in southern China, seven species clearly related to *Endophragmiella* were collected from dead branches. Four are described here as new, and the other three represent new records for the Chinese mycota.

Taxonomy

Endophragmiella chinensis L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 1

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Differs from *Endophragmiella bohaniensis* by its oblong or cylindrical, smaller conidia on branched, shorter, and narrower conidiophores; and from *E. constricta, E. fallacia,* and *E. oblonga* by its smaller, concolorous conidia.

Type: China, Jiangxi Province, Lushan Mountain, on dead branches of an unidentified broadleaf tree, 18 October 2016, J. Ma (**holotype**, HJAUP M0477).

Etymology: refers to China where the fungus was collected.

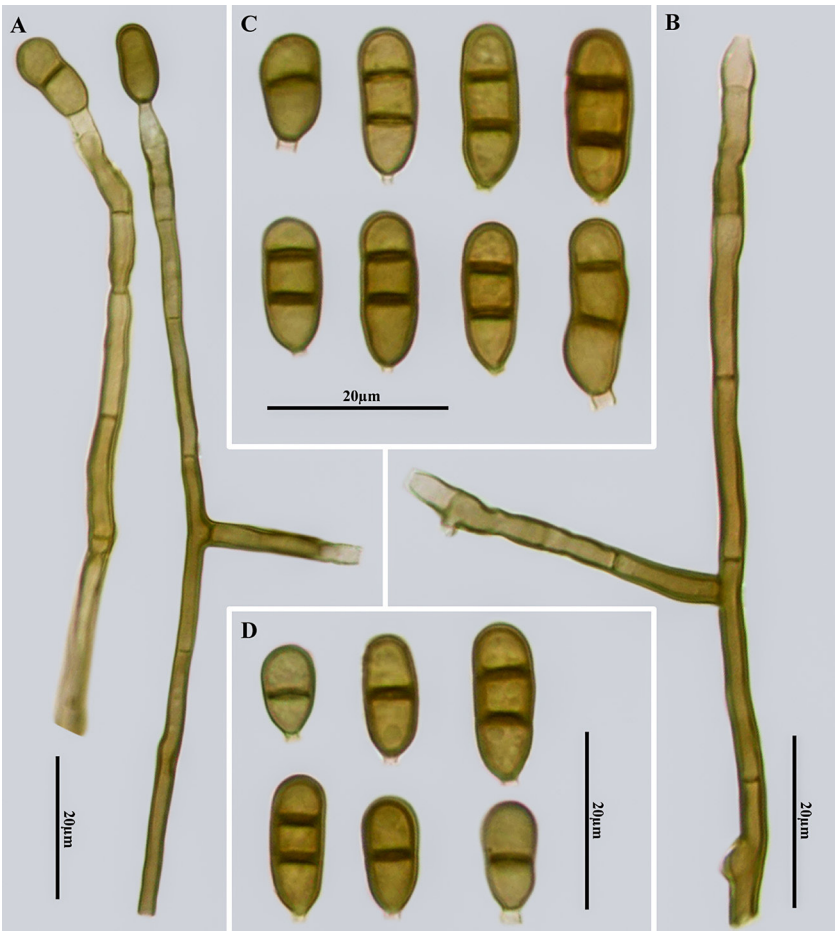

Fig. 1. *Endophragmiella chinensis* (holotype, HJAUP M0477).
A. Conidiophores, conidiogenous cells, and conidia; B. Conidiophore; C, D. Conidia.

Colonies on the natural substrate effuse, brown to dark brown. Mycelium partly immersed, partly superficial, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores macronematous, mononematous, single or aggregated at the base, simple or branched, erect, straight or flexuous, septate, smooth, medium brown to brown, paler towards the apex, 83–115 × 2.5–4 μm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, pale brown, attenuated into

narrow and truncate at the apex, with 0–2 percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, smooth, thick-walled, (1–)2-euseptate, the septum usually becoming darker and forming a band; when mature oblong or cylindrical, medium brown, (11–)14–21 µm long, (4.5–)6–7.5 µm diam. in the broadest part; apex rounded; base truncate, 1–2 µm diam., with a distinct 1–1.5 µm long basal frill derived from the distal end of the conidiogenous cell.

Comments—Among the *Endophragmiella* taxa with predominantly 2-euseptate conidia, *E. chinensis* is most similar to *E. bohaniensis* N.D. Sharma (Sharma 1985), *E. constricta* M.T. Dunn (Dunn 1982), *E. fallacia* P.M. Kirk (Kirk 1981a), and *E. oblonga* Matsush. ex S. Hughes (Hughes 1979) in conidial shape. However, *E. bohaniensis* differs by its broadly ellipsoidal to oblong, larger conidia (18–33 × 8.5–12.5 µm) on unbranched longer and wider conidiophores (75–300 × 5–6 µm; Sharma 1985); *E. constricta* differs by its brown larger conidia (15–23 × 6.9–10.4 µm) with paler lower cell and constricted middle cell (Dunn 1982); *E. oblonga* and *E. fallacia* differ mainly in their unbranched conidiophores, and larger versicolored conidia (*E. oblonga* 19–28 × 9.5–11.5 µm, Hughes 1979; *E. fallacia* 22–26 × 10–12 µm, Kirk 1981a).

Endophragmiella guangdongensis L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 2

IF 557449

Differs from *Endophragmiella cesatii* and *E. latispora* by its smaller predominantly 2-euseptate conidia; from *E. lauri* by its versicolored wider conidia; and from *E. curvata* by its wider conidia with the longest central or suprabasal cell.

Type: China, Guangdong Province: Liuxihe National Forest Park, on dead branches of an unidentified broadleaf tree, 17 October 2014, J. Ma (**holotype**, HJAUP M0118).

Etymology: refers to the province in which the fungus was found.

Colonies on the natural substrate effuse, brown to dark brown. Mycelium partly immersed, partly superficial, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores macronematous, mononematous, single or aggregated at the base, unbranched, erect, straight or flexuous, septate, smooth, brown to dark brown, up to 530 × 4.5–5.5 µm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, brown, with up to 25 or more percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, fusiform or ellipsoidal, smooth, 2(–3)-euseptate, brown with the paler end cells, 20.5–29.5 µm long, 8.5–10.5 µm diam. in the broadest

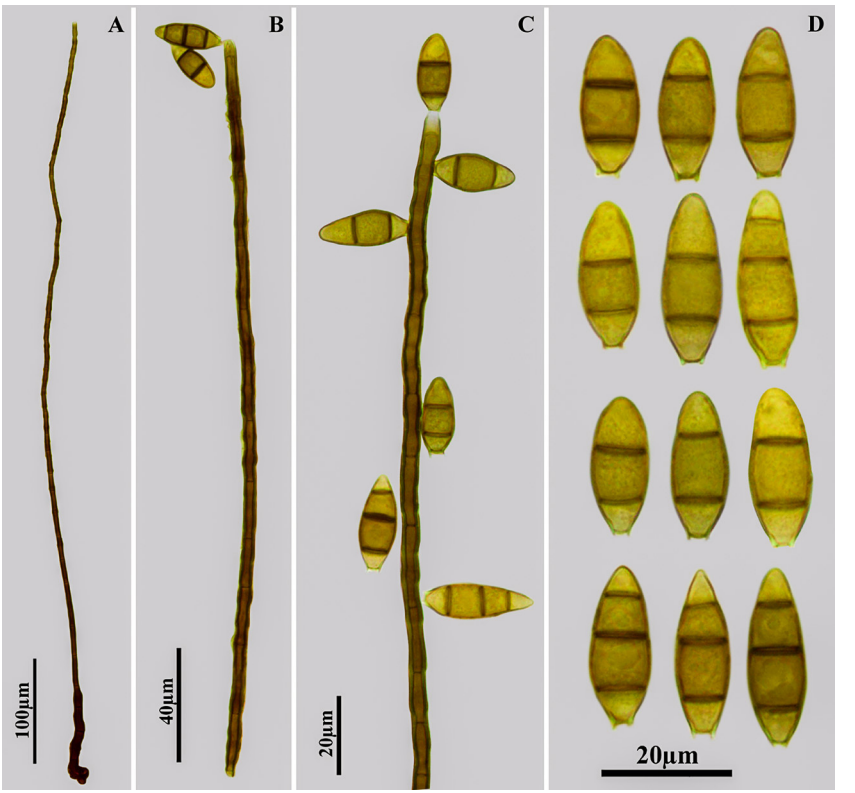

Fig. 2. *Endophragmiella guangdongensis* (holotype, HJAUP M0118).
A. Conidiophore; B, C. Conidiophores, conidiogenous cells, and conidia; D. Conidia.

part; apex rounded or acute; base truncate, 2.5–4 µm diam., with a distinct 0.5–1 µm long basal frill derived from the distal end of the conidiogenous cell.

Comments—In terms of conidial morphology, *E. guangdongensis* is most similar to *E. latispora* W.P. Wu (Wu & Zhuang 2005), *E. lauri* P.M. Kirk & C.M. Kirk (Kirk 1982), and *E. curvata* (Corda) S. Hughes and *E. cesatii* (Mont.) S. Hughes (Hughes 1979), but *E. cesatii* and *E. latispora* differ by their predominantly 3-euseptate, larger conidia (*E. cesatii* 32–40(–45) × 11–12.5 µm, Hughes 1979; *E. latispora* 23–35 × 12–13 µm, Wu & Zhuang 2005); *E. curvata* differs by its narrower (7.2–8.3 µm) conidia with the lowest cell longer than other cells; and *E. lauri* differs by its concolorous, narrower (7–8 µm) conidia (Kirk 1982).

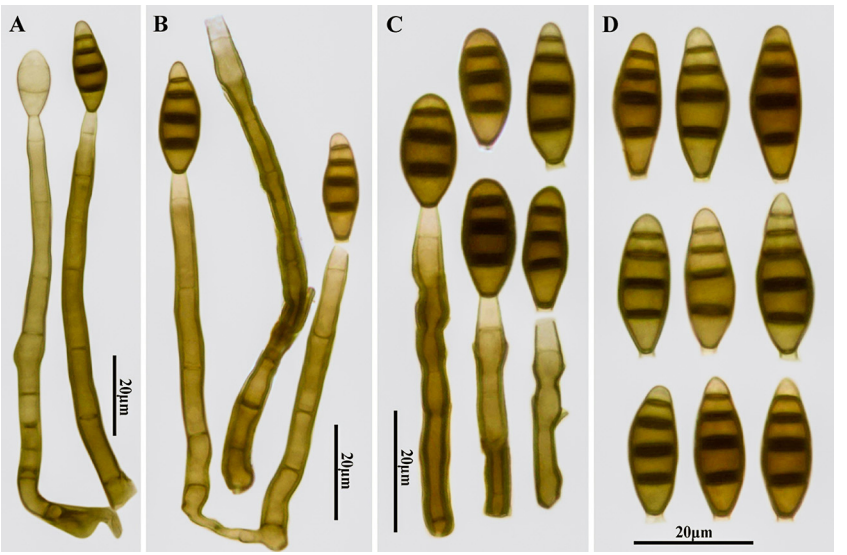

Fig. 3. *Endophragmiella lushanensis* (holotype, HJAUP M0436).
A–C. Conidiophores, conidiogenous cells, and conidia; D. Conidia.

Endophragmiella lushanensis L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 3

IF 557450

Differs from *Endophragmiella fagicola*, *E. latispora*, *E. socia*, and *E. valdiviana* by its conspicuously smaller predominantly 4-euseptate conidia.

Type: China, Jiangxi Province, Lushan Mountain, on dead branches of an unidentified broadleaf tree, 18 October 2016, J. Ma (**holotype**, HJAUP M0436).

Etymology: refers to the locality in which the fungus was found.

Colonies on the natural substrate effuse, brown to dark brown. Mycelium partly immersed, partly superficial, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores macronematous, mononematous, single or aggregated at the base, unbranched, erect, straight or flexuous, septate, smooth, medium brown to dark brown at the lower part, pale brown towards the apex, 54–160 × 4.5–6 μm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, pale brown, attenuated into narrow and truncate apex of 2.5–3 μm wide, determinate, with up to 3 percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, ellipsoidal, fusiform or obclavate, smooth, (3–)4(–5)-euseptate, the septum

usually becoming darker and forming a band, medium brown to brown, apical cell pale brown to subhyaline, 20–29 µm long, 7–9 µm diam. in the broadest part; apex rounded; base truncate, 2.5–3 µm diam., with a distinct 0.5–1 µm long basal frill derived from the distal end of the conidiogenous cell.

Comments—Among the known species of *Endophragmiella*, *E. lushanensis* is most similar in conidial shape to *E. fagicola* P.M. Kirk (Kirk 1981b), *E. latispora* (Wu & Zhuang 2005), *E. socia* (M.B. Ellis) S. Hughes, and *E. valdiviana* (Speg.) S. Hughes (Hughes 1979), but *E. fagicola* differs by its obvious larger (70–90 × 11–17 µm) usually 5-euseptate conidia (Kirk 1981b); *E. latispora* differs by its wider (12–13 µm) predominantly 3-euseptate conidia (Wu & Zhuang 2005); *E. socia* and *E. valdiviana* differ by their larger predominantly 7-euseptate conidia (*E. socia* 36–50 × 10.8–14.4 µm; *E. valdiviana* 40–50 × 11–12.5 µm) (Hughes 1979).

Endophragmiella obovoidea L. Qiu, Jian Ma, R.F. Castañeda & X.G. Zhang, **sp. nov.** Fig. 4

IF 557451

Differs from *Endophragmiella occidentalis*, *E. aseptata*, and *E. fatrensis* by its obovoid, smooth, pale brown, smaller conidia.

Type: China, Jiangxi Province: Lushan Mountain, on decaying twigs of an unidentified broadleaf tree, 18 October 2016, J. Ma (**holotype**, HJAUP M0475).

Etymology: refers to the obovoid conidial shape.

Colonies on the natural substratum effuse, brown to dark brown. Mycelium partly immersed, partly superficial, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores macronematous, mononematous, single or aggregated at the base, simple, erect, straight or flexuous, septate, smooth, pale brown to brown, paler towards the apex, ≤230 × 3–4 µm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, pale brown, attenuated into narrow and truncate at the apex, with up to 26 (or more) percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, smooth, thick-walled, obovoid, sometimes ellipsoidal, aseptate, pale brown, 8–9.5 × 5–6 µm, with a distinct 0.5–1.5 µm long basal frill derived from the distal end of the conidiogenous cell.

Comments—Among the known species of *Endophragmiella* with aseptate conidia, *E. obovoidea* somewhat resembles *E. occidentalis* R.F. Castañeda & al. (Castañeda-Ruíz & al. 1995), *E. aseptata* Hol.-Jech., and *E. fatrensis* Hol.-Jech. (Holubová-Jechová 1986), but *E. occidentalis* differs by its obovate, smooth, rarely verrucose, dark brown, larger conidia (10–12 × 9–11 µm; Castañeda-

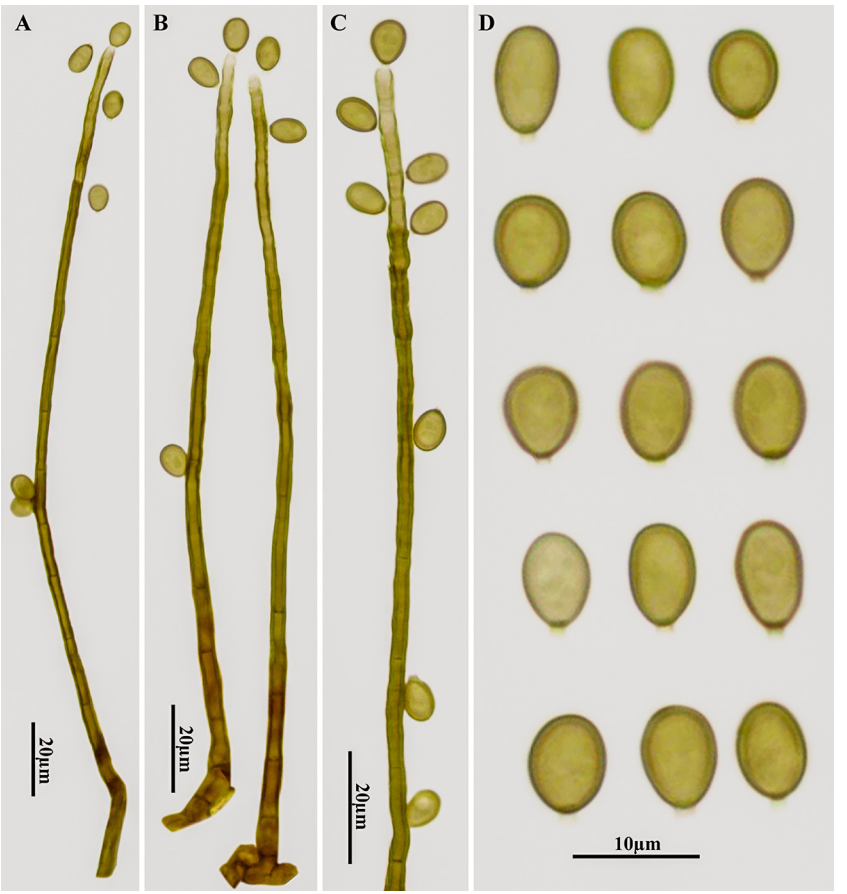

Fig. 4. *Endophragmiella obovoidea* (holotype, HJAUP M0475).
A–C. Conidiophores, conidiogenous cells, and conidia; D. Conidia.

Ruíz & al. 1995); *E. aseptata* differs by its ellipsoidal or ovoid, brown, larger conidia (7–11 × 6–7.5 μm; Holubová-Jechová 1986); and *E. fatrensis* differs by its ellipsoidal to ovoidal, mid to dark smoke-brown, larger conidia (11–15.5 × 7–8.5 μm; Holubová-Jechová 1986].

Endophragmiella cantabrica J. Mena, Hern.-Restr., Gené & Guarro, Mycotaxon 123: 225, 2013. Fig. 5

Conidiophores macronematous, mononematous, single, unbranched, erect, straight or flexuous, 7–13-septate, smooth, brown to dark brown, paler

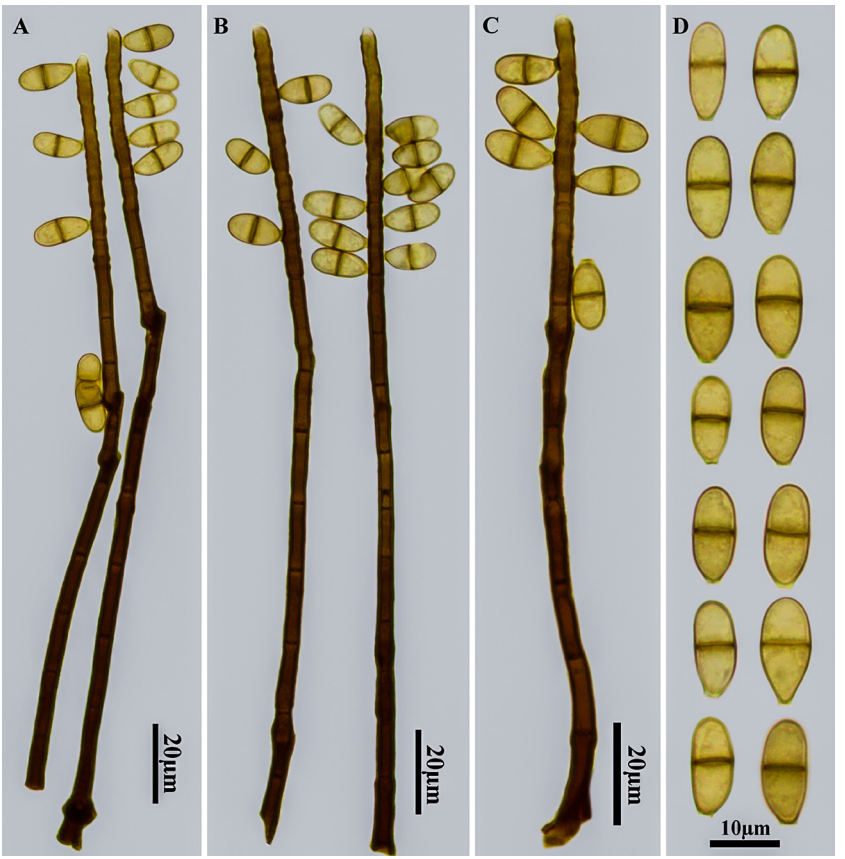

Fig. 5. *Endophragmiella cantabrica* (HJAUP M001).
A–C. Conidiophores, conidiogenous cells, and conidia; D. Conidia.

towards the apex, ≤220 × 3.5–4.5 µm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, brown, with ≤20 percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, oblong, ellipsoidal or sometimes obovoid, smooth, thick-walled, medially 1-euseptate, pale brown, 13–15.5 µm long, 5.5–7 µm diam. in the broadest part; apex rounded; base truncate, 2–2.5 µm diam., with a distinct 0.5–1 µm long basal frill derived from the distal end of the conidiogenous cell.

Specimen examined: **China, Jiangxi Province**, Jinggangshan Mountain, on dead branches of an unidentified broadleaf tree, 16 October 2012, J. Ma (HJAUP M001).

Comments—Hernández-Restrepo & al. (2013) recorded this fungus on dead wood from Spain, and compared it with similar species, including *E. arranensis* P.M. Kirk, *E. bogoriensis* Rifai, *E. ovoidea* P.M. Kirk, and *E. uniseptata* var. *pusilla* Hol.-Jech. This is the first report of *E. cantabrica* in China. Our collection fits well with the original description of *E. cantabrica* except for our slightly larger conidia (cf. 10–14 × 5–6 μm; Hernández-Restrepo & al. 2013).

Endophragmiella ellisii P.M. Kirk, Index Fungorum 421: 1, 2019. Fig. 6

"*Endophragmia biseptata*" M.B. Ellis, Mycol. Pap.72: 31. 1959, nom. inval.

"*Endophragmiella ellisii*" S. Hughes, N.Z. J. Bot. 17(2): 150, 1979, nom. inval.

Conidiophores macronematous, mononematous, single or aggregated at the base, unbranched, erect, straight or flexuous, 4–9-septate, smooth, brown to dark brown, paler towards the apex, 70–140 × 5–6.5 μm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, pale brown, with

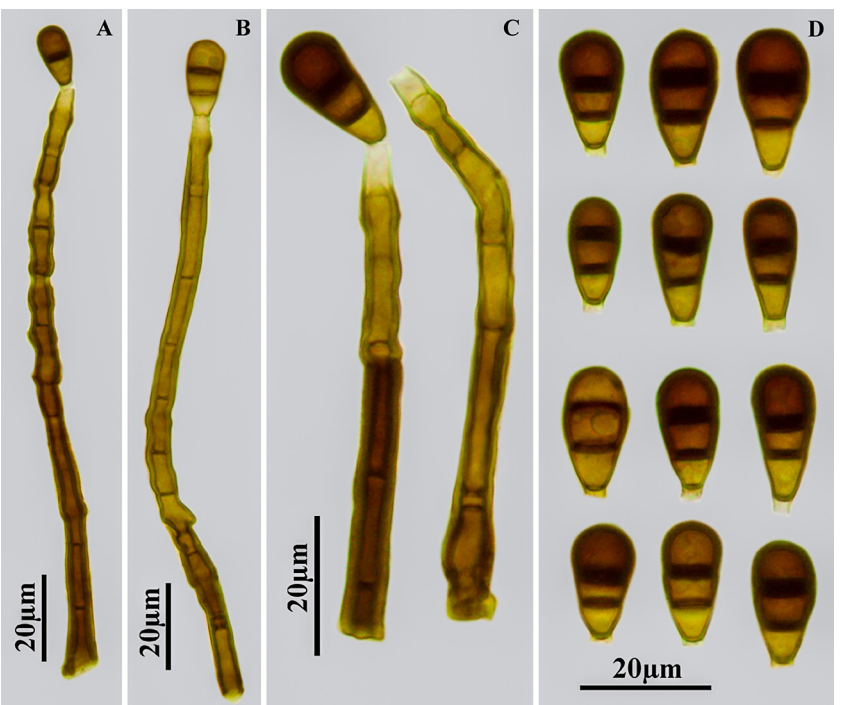

Fig. 6. *Endophragmiella ellisii* (HJAUP M0316).
A–C. Conidiophores, conidiogenous cells, and conidia; D. Conidia.

≤14 percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, obovoid to pyriform, smooth, thick-walled, 2-euseptate, the septum usually becoming darker and forming a band, distal cell brown to dark brown, central cell pale brown to brown and basal cell paler, 17.5–23.5 µm long, 8–11.5 µm diam. in the broadest part; apex rounded; base truncate, 2.5–3.5 µm diam., with a distinct 0.5–2 µm long basal frill derived from the distal end of the conidiogenous cell.

Specimens examined: **CHINA, Jiangxi Province**, Jiulianshan National Nature Reserve, on dead branches of an unidentified broadleaf tree, 3 November 2014, J. Ma (HJAUP M0316); **Hainan Province**, Jianfengling National Nature Reserve, on dead branches of an unidentified broadleaf tree, 15 April 2015, J. Ma (HJAUP M0402).

Comments –The previous invalid publication of "*E. ellisii*" was validated in Senwanna (2019). This species has not previously been recorded from China. Our specimen overlaps well with the original descriptions of Ellis (1959). *Endophragmiella ellisii* is most similar to *E. bisbyi* B. Sutton ex P.M. Kirk (Senwanna 2019) and *E. hughesii* D. Hawksw. (Hawksworth 1979) in conidial shape, but *E. bisbyi* differs by its predominantly 3-euseptate, smaller conidia (12.5–16 × 6.3–7.6 µm; Hughes 1979), and *E. hughesii* differs by its larger conidia (25–30 × 11–13 µm) with a central pore at each septum (Hawksworth 1979).

Endophragmiella uniseptata M.B. Ellis ex P.M. Kirk, Index Fungorum 421: 1, 2019. Fig.7

"*Endophragmia uniseptata*" M.B. Ellis, Mycol. Pap.72: 28. 1959, nom. inval.

"*Endophragmiella uniseptata*" M.B. Ellis ex S. Hughes, N.Z. J. Bot. 17(2): 156, 1979, nom. inval.

Conidiophores macronematous, mononematous, single or aggregated at the base, unbranched, erect, straight or flexuous, 2–7-septate, smooth, brown to dark brown, 55–139 × 4–6 µm. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, smooth, pale brown to brown, determinate or with 1–3 percurrent elongations. Conidial secession rhexolytic. Conidia solitary, acrogenous, obovoid, smooth, 1-euseptate, the septum usually becoming darker and forming a band, brown to dark brown with the lower cell sometimes slightly paler, 15.5–21 µm long, 10–12.5 µm diam. in the broadest part; apex rounded; base truncate, 2.5–3.5 µm diam., with distinct 0.5–1 µm long basal frill derived from the distal end of the conidiogenous cell.

Specimen examined: **CHINA**, **Guangdong Province**, Nanling National Nature Reserve, on dead branches of an unidentified broadleaf tree, 12 July 2014, J. Ma (HJAUP M0137).

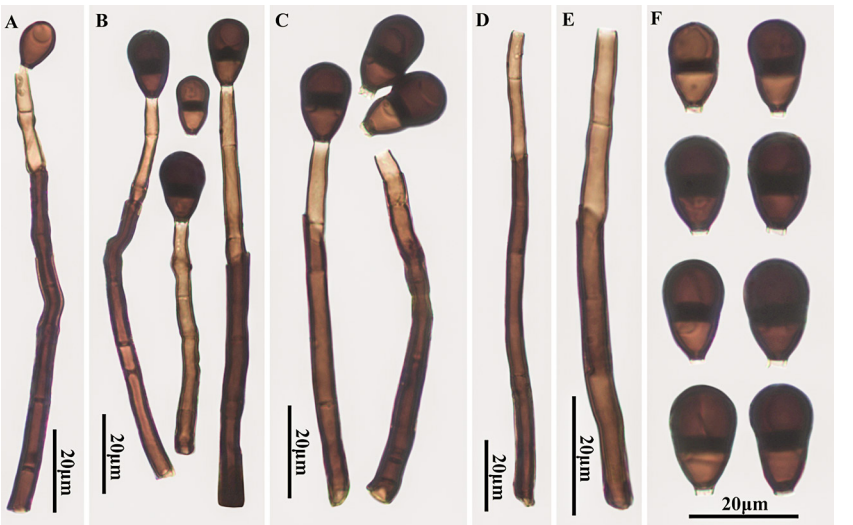

Fig. 7. *Endophragmiella uniseptata* (HJAUP M0137).
A–C. Conidiophores, conidiogenous cells, and conidia; D, E. Conidiophores; F. Conidia.

Comments—Ellis (1959) reported this species on rotten wood of *Castanea saliva* and *Fagus sylvatica* from Great Britain. The previous invalid publication of "*E. uniseptata*" was validated in Senwanna (2019). *Endophragmiella uniseptata* is similar to *E. pinicola* M.B. Ellis ex P.M. Kirk (Senwanna 2019) in conidial shape, but *E. pinicola* has concolorous, smaller conidia (10–14 × 5–9 µm; Ellis 1976). Our collection corresponds well with the description of Ellis (1959; as "*Endophragmia uniseptata*") except for much fewer percurrent elongations of conidiogenous cells in our specimen (cf. up to 15; Ellis 1959). This is the first report of this species in China.

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